

# Claims

- [c1] 1.A method of forming a shallow trench isolation, comprising:
- providing a substrate;
  - forming a patterned mask layer over a substrate;
  - etching a portion of the substrate exposed by the patterned mask to form a trench in the substrate;
  - forming a first insulating layer over such that a portion of the first insulating layer is formed over the patterned mask layer, a portion of the first insulating layer fills the trench and a portion of the patterned mask layer surrounding the trench remain exposed;
  - removing the exposed portion of the first insulating layer surrounding the trench;
  - forming a liner layer over the first insulating and on a remaining portion of the patterned mask layer;
  - forming a second insulating layer over the liner layer;
  - performing a planarization process to remove a portion of the second insulating layer, a portion of the liner layer and a portion of the portion of the first insulating layer formed on the patterned mask layer until the remaining portion of the patterned mask layer is exposed; and
  - removing the patterned mask layer.

- [c2] 2. The method according to claim 1, wherein after the step of removing the patterned mask layer, further comprising removing the second insulating layer so that the liner layer is exposed.
- [c3] 3. The method according to claim 1, wherein the step of forming the insulating layer over the mask layer and in the trench is carried out by performing a high density plasma chemical vapor deposition (HDP-CVD) process.
- [c4] 4. The method according to claim 1, wherein the liner layer has a lower etching selectivity relative to the first insulating layer.
- [c5] 5. The method according to claim 1, wherein the liner layer has a lower etching selectivity relative to the second insulating layer.
- [c6] 6. The method according to claim 1, wherein the liner layer has a thickness between 50 angstrom to 200 angstrom.
- [c7] 7. The method according to claim 1, wherein the liner layer comprises an insulating layer.
- [c8] 8. The method according to claim 6, wherein the liner layer is a silicon nitride layer.

- [c9] 9. The method according to claim 1, further comprising a step of forming a pad oxide layer on the substrate before the step of forming the patterned mask layer.
- [c10] 10. The method according to claim 9, wherein after the step of removing the patterned mask layer, further comprising removing the pad oxide layer not covered by the liner layer and removing the second insulating layer partially to form a thinner second insulating layer.
- [c11] 11. The method according to claim 10, wherein the second insulating layer is removed when removing the pad oxide layer not covered by the liner layer.
- [c12] 12. A shallow trench isolation, comprising:  
a substrate, having a trench therein;  
an insulating layer, disposed in the trench, wherein the insulating layer has an upper surface higher than an upper surface of the substrate; and  
a liner layer, formed over the substrate covering the insulating layer.
- [c13] 13. The shallow trench isolation according to claim 12, wherein the liner layer further extends to an upper surface of the substrate.
- [c14] 14. The shallow trench isolation according to claim 12, wherein the liner layer has a low etching selectivity rela-

tive to the insulating layer.

- [c15] 15. The shallow trench isolation according to claim 12, wherein the liner layer has a thickness between 50 angstrom to 200 angstrom.
- [c16] 16. The shallow trench isolation according to claim 12, wherein the liner layer comprises an insulating layer.
- [c17] 17. The shallow trench isolation according to claim 16, wherein the liner layer is a silicon nitride layer.
- [c18] 18. The shallow trench isolation according to claim 12, further comprising a pad oxide layer formed between the liner layer and the substrate.
- [c19] 19. The shallow trench isolation according to claim 12, further comprising another insulating layer covering the liner layer.